




UNIVERSITÀ
degli STUDI
di CATANIA

 **DIEEI**
Dipartimento di Ingegneria Elettrica, Elettronica e Informatica

Interoperability between OPC UA and oneM2M

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Research Scope

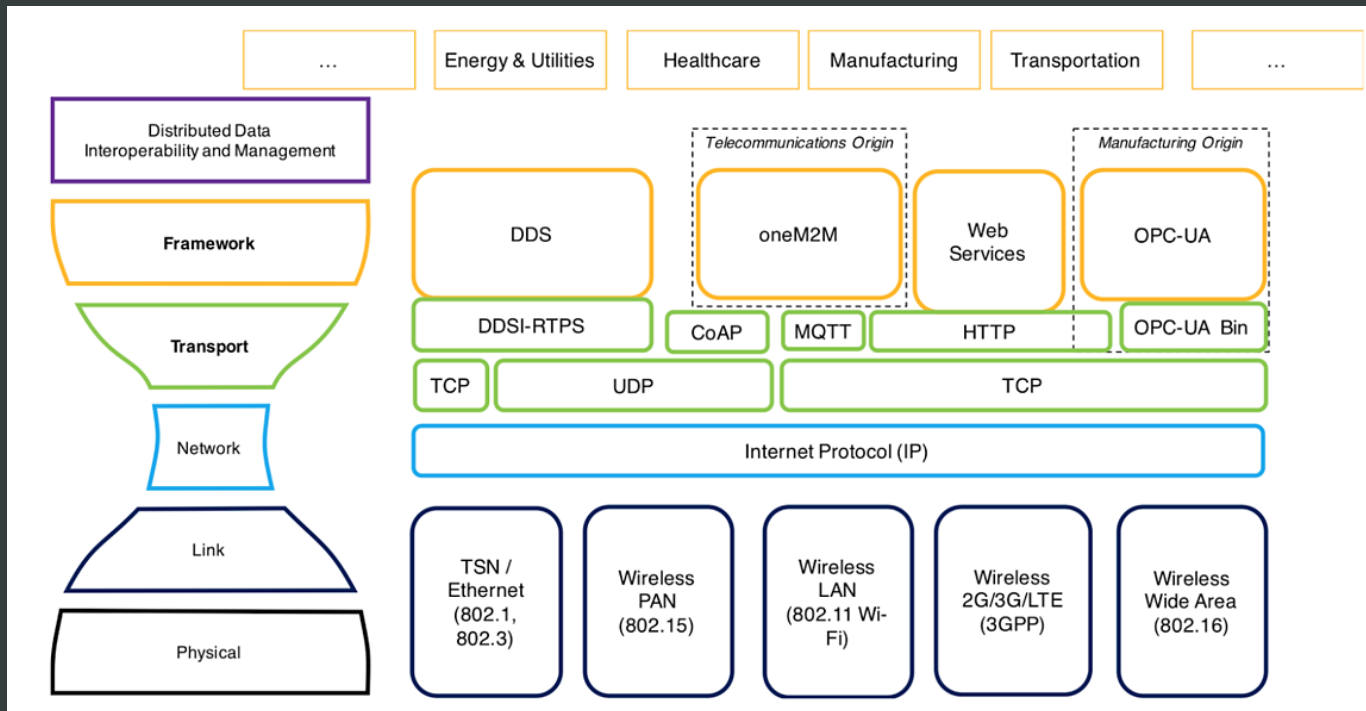
- The 4th industrial revolution (Industry 4.0- I4.0):
 - Flexible and innovative production process leading to new business models and added value.
 - Connecting business processes across company borders
- Some technologies:
 - Internet of Things (IoT) & Industrial IoT
 - Cloud Manufacturing
 - Industrial Analytics
 - Cyber-Physical Systems (CPS)
- One of the main requirements:
 - Interoperability
 - Definition of Reference Architectures: RAMI 4.0, IIRA



Research Scope

Industrial Internet Reference Architecture (IIRA) by the IIC (Industrial Internet Consortium)^[1]

- Solutions for getting data between applications
- Transport and Framework layer



- In order to achieve interoperability IIRA defines **Gateways** enabling interworking between different frameworks
- Very recent draft version of the gateway between OPC UA and DDS ^[2] has been defined
- No other Gateways exist

[1] Industrial Internet Consortium. 2018. *The Industrial Internet of Things Volume G5: Connectivity Framework (Version 1.01)*, available at https://www.iiconsortium.org/pdf/IIC_PUB_G5_V1.01_PB_20180228.pdf

[2] Object Management Group (OMG), "OPC UA/DDS Gateway", available at <https://www.omg.org/spec/DDS-OPCUA/About-DDS-OPCUA/>

Interworking between OneM2M and OPC UA

ONEM2M

- placed at the higher level of factory production systems, allowing realization of services like *SCM*
- advanced data analytics

OPCUA

- adopted in factories at the lower level of the production systems
- typically collect data coming from PLCs (Programmable Logic Controllers), sensors and actuators.



Interworking between OPC UA and oneM2M may allow data produced by OPC UA-based devices to be consumed by oneM2M applications;

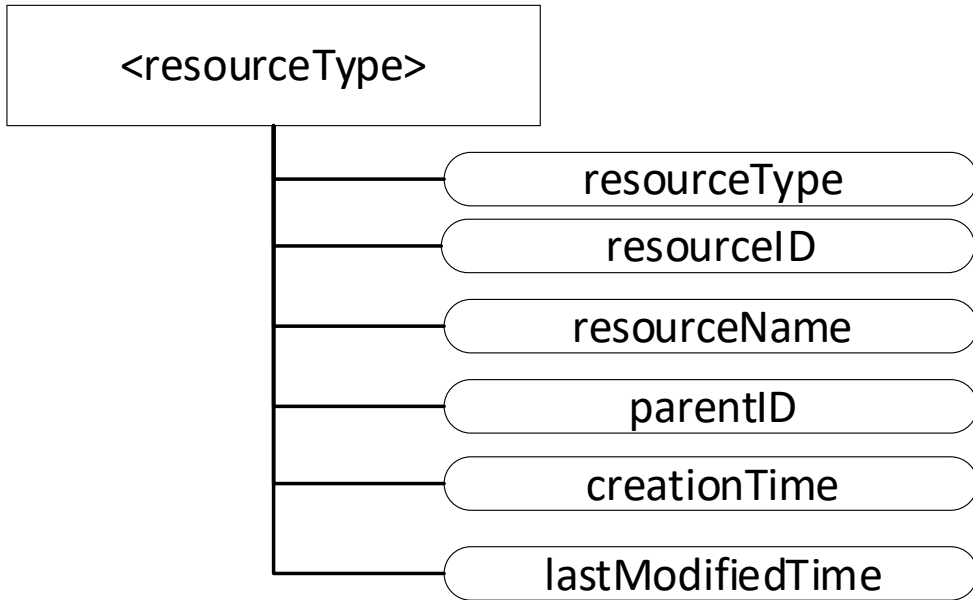
Our proposal


1. Mapping relevant data models [1]
2. Definition of an interworking scheme [2]
3. Details on interworking procedures
4. API Development

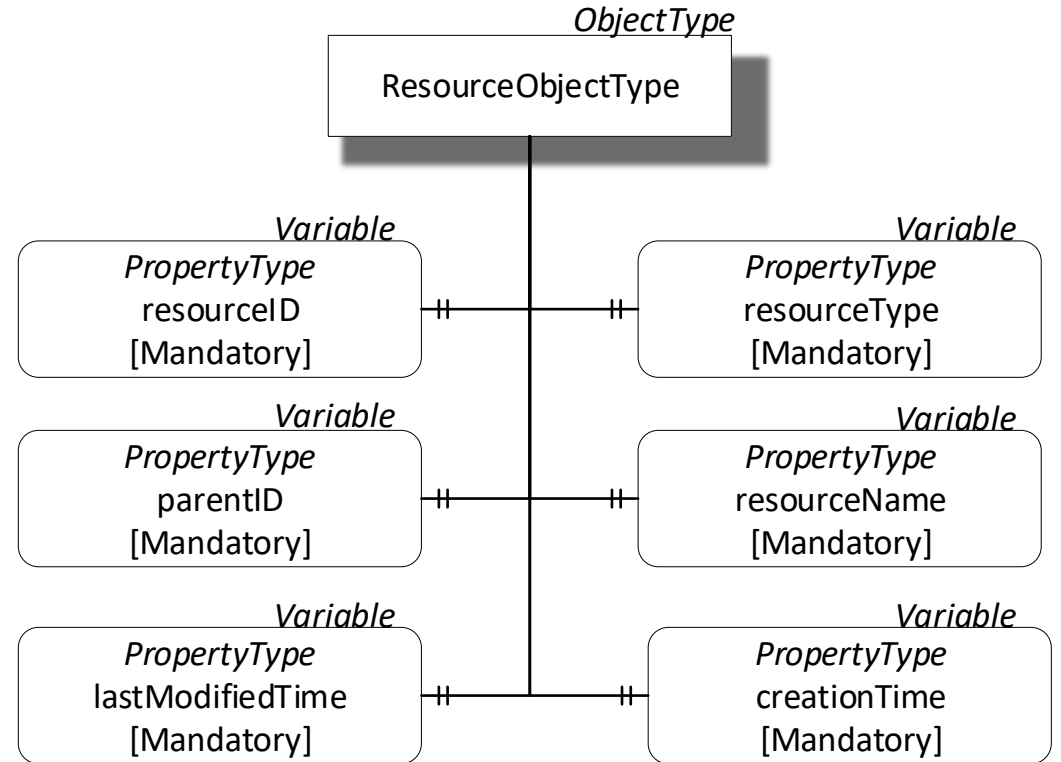
[1] Cavalieri S, Mulè S, Salafia MG. Enabling OPC UA and oneM2M Interworking. In: Proceedings of IEEE International Conference on Industrial Technologies (ICIT 2020). Buenos Aires, Argentina. 2020.

[2] Cavalieri S, Mulè S. Towards Interoperability of oneM2M and OPC UA. In: Proceedings of International Conference on Enterprise Information System (ICEIS 2020). Prague (Czech Republic). 2020.

Mapping - Data Models



Mapping 



oneM2M resourceType representation with universal attributes

ResourceObjetType ObjectType in OPC UA

Mapping – Interworking scheme

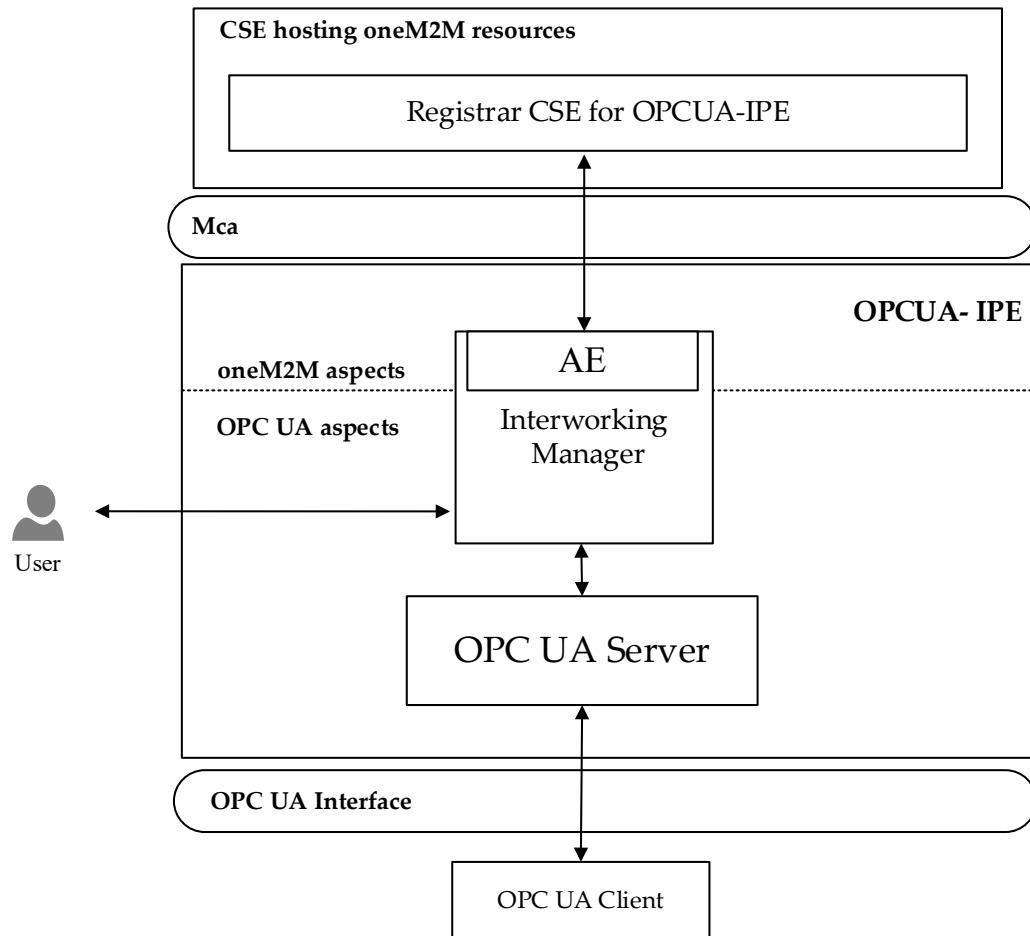


Figure 8. OPCUA-IPE architecture.

- Based on **Interworking Proxy Entity (IPE)** defined in oneM2M
- **Interworking Manager** performs several activities to enable interworking
- **OPC UA Server** exposing oneM2M resources

Mapping – Interworking scheme

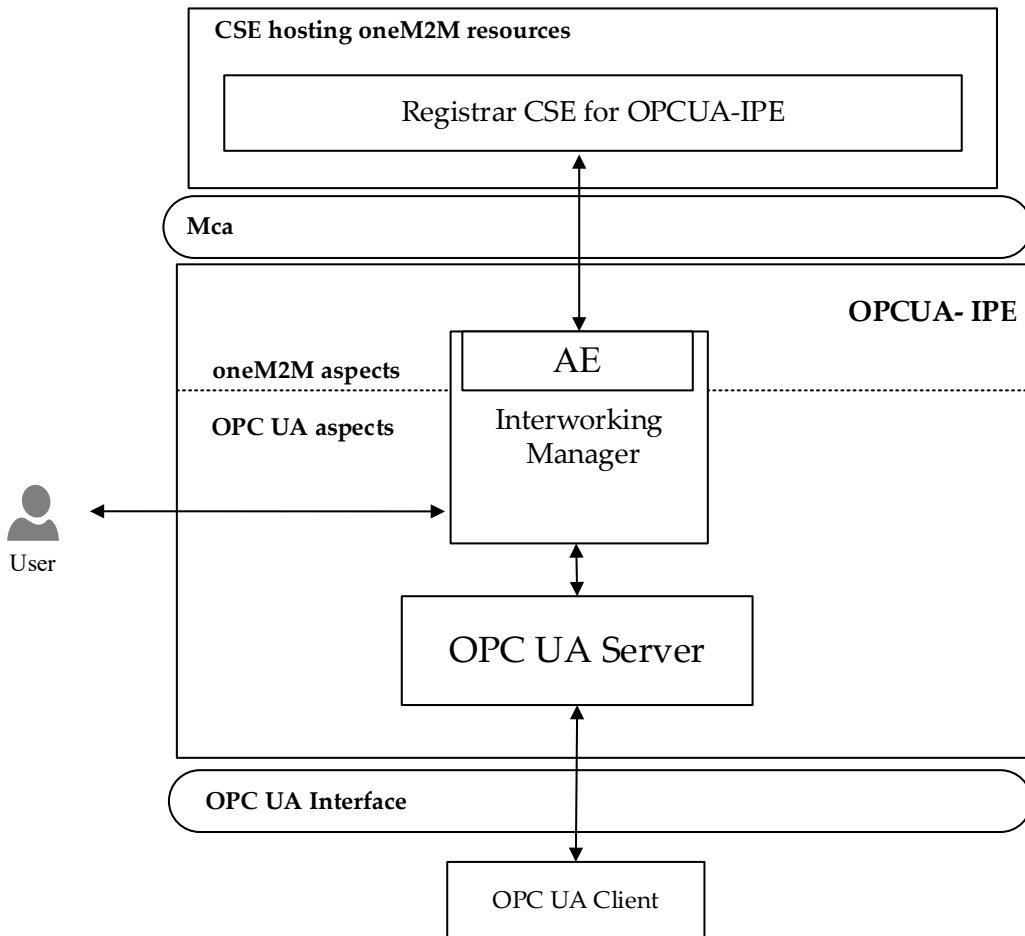
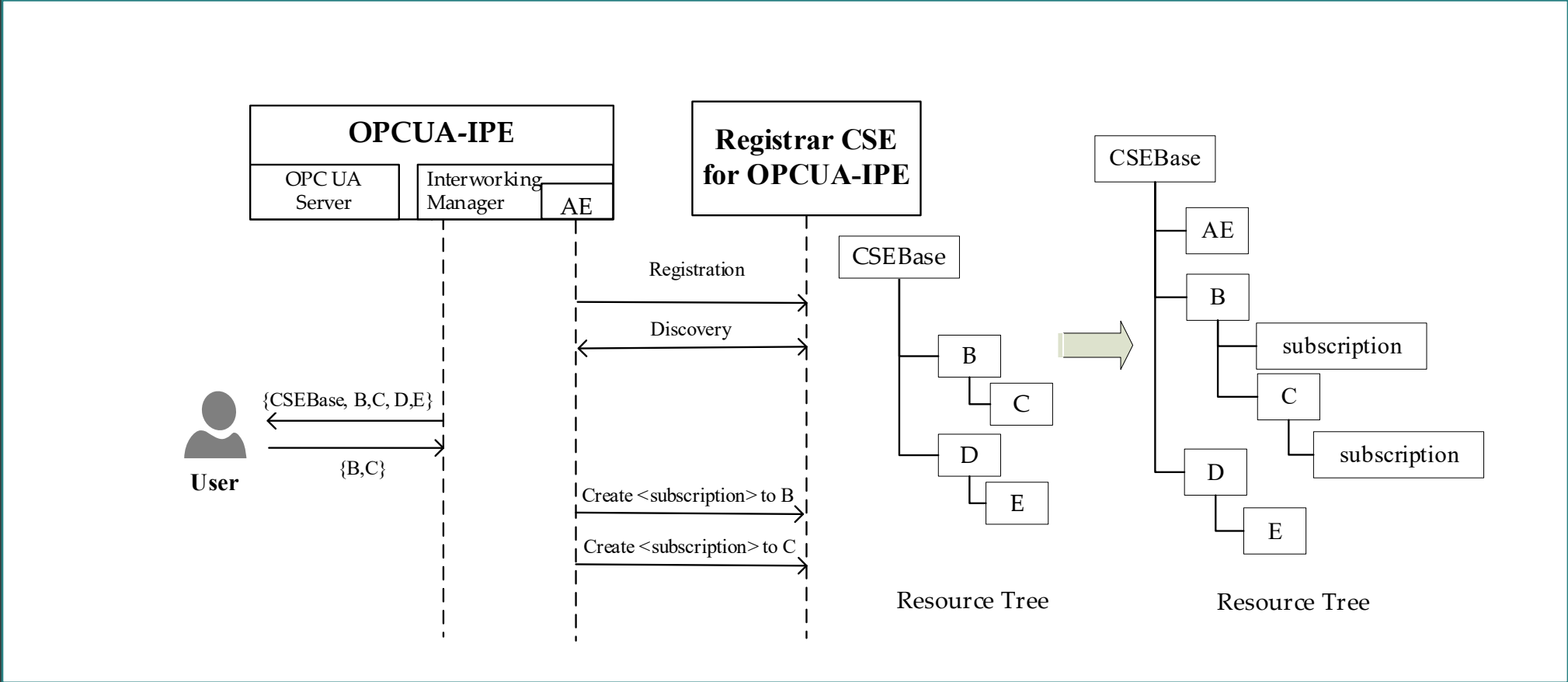


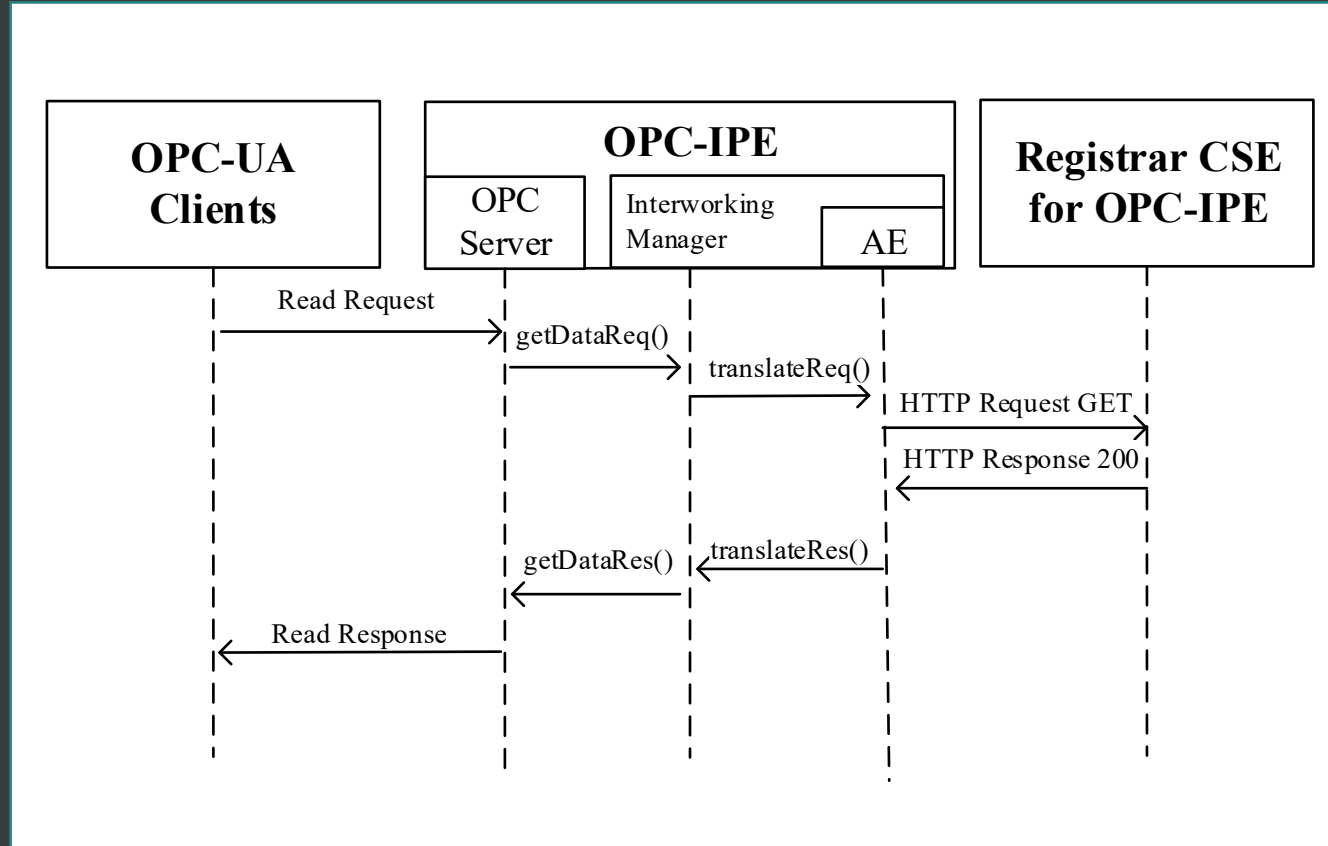
Figure 8. OPCUA-IPE architecture.

- Data Mapping
- Choice of oneM2M resources to be exposed
- Creation of an OPC UA Server instance
- Triggering changes
- Monitoring Request
- Managing the dynamic adding/deletion

Resource Selection - Discovery



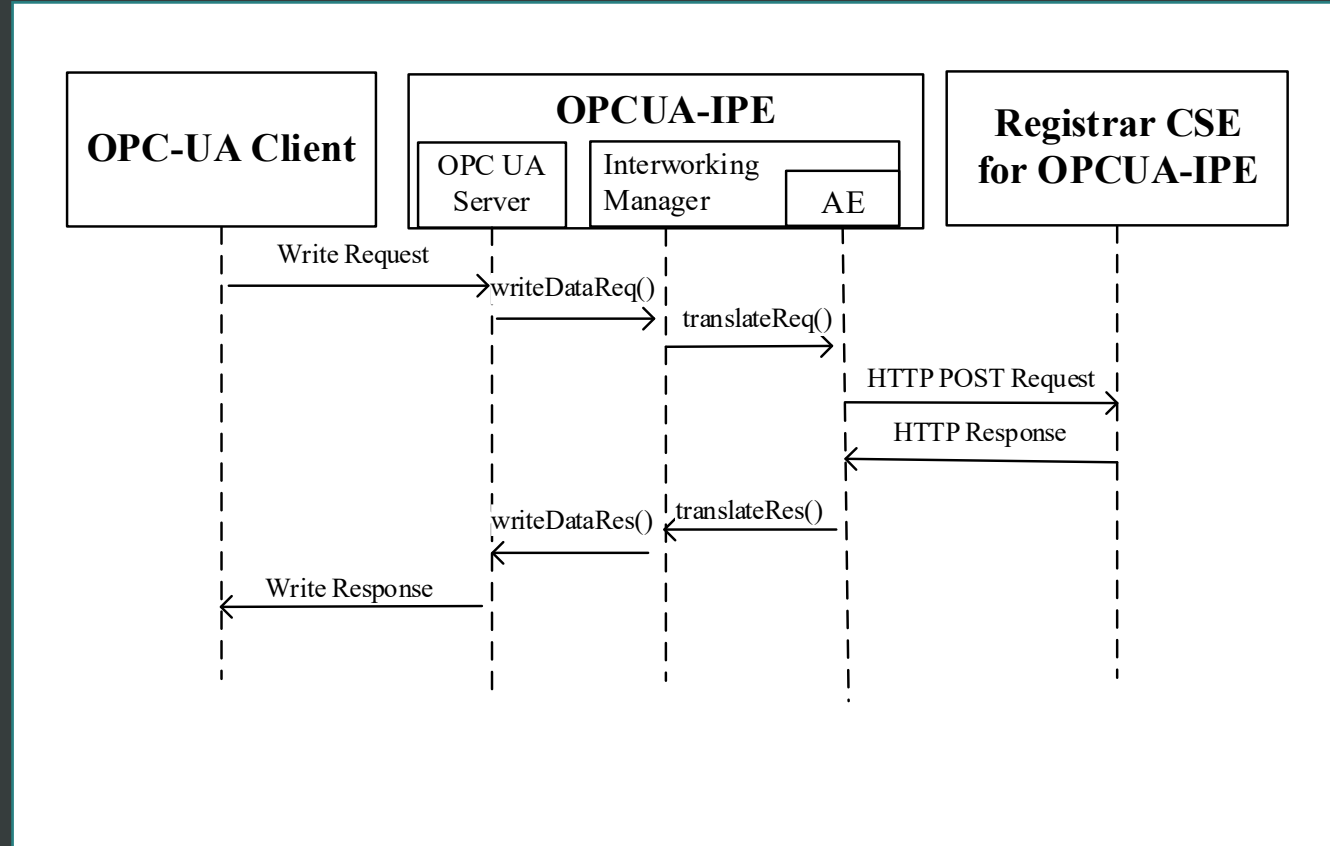
Interworking Procedures – Read



Read request from OPC UA Client mapped as **HTTP GET Request**:

- Interworking Manager translate request and waiting for response;
- Value from HTTP GET returned to OPC UA Client ;

Interworking Procedures – Write



Write request from OPC UA Client mapped as **HTTP POST Request**:

- Interworking Manager translate request and waiting for response
- Write response will be confirmed by Interworking Manager

API Development

- Resource discovery service
- Mapping oneM2M resource in OPC UA Node
- Request Management from OPC UA Side (Read, Write, MonitoredItem)
- Data changes triggering

Test:

CSE Base Docker Image

UaExpert

Local OPCUA IPE :

- OPC UA Server with FreeOPCUA open source library;
- OpenMTC SDK

THANKS
FOR YOUR ATTENTION